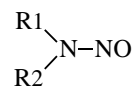


DIALKYLNITROSAMINES

CAS Registry Number: See Table 2

Molecular Formula: See Table 2



N-Nitrosamines

R₁ and R₂ = organic groups

Dialkylnitrosamines include a group of chemicals of the form R₁R₂NNO, where R₁ and R₂ are alkyl groups such as methane, ethane, alcohols, or other organic groups. Table 1 provides a partial list of dialkylnitrosamines. Many of these compounds occur as yellow liquids or crystals. For specific information on either n-nitrosodimethylamine, N-nitroso-N-methylurea or N-nitrosomorpholine, please refer to their corresponding summary sheets.

Table 1
Partial List of Dialkylnitrosamines

Synonyms: N-Nitrosamines; N-Nitroso compounds

Examples:

N-Nitrosodiethylamine	N-Nitrososarcosine
N-Nitrosodiethanolamine	N-Nitrosodimethylamine
N-Nitrosodiphenylamine	N-Nitrosodi-n-propylamine
N-Nitroso-N-ethylurea	N-Nitroso-N-methylurea
N-Nitroso-N-methylurethane	N-Nitrosomethylvinylamine
N-Nitrosomorpholine	N-Nitrosornicotine
N-Nitrosopiperidine	N-Nitrosopyrrolidine
3-(N-Nitrosomethylamino)propionitrile	N-Nitrosomethylethylamine

(CCR, 1994; IARC, 1987; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Many dialkylnitrosamines are used in research, while only a few have commercial uses. N-nitrosodimethylamine is used as an industrial solvent, a rubber accelerator, in the production of rocket fuel, and as a nematicide. N-nitrosodiethylamine is used as a gasoline and lubricant

additive, an antioxidant, and a stabilizer (HSDB, 1993). A number of N-nitroso compounds have

been found in tobacco smoke (NTP, 1994a).

The primary stationary sources that has reported emissions of dialkylnitrosamines in California are manufacturers of guided missiles and space vehicles and parts (ARB, 1997b).

B. Emissions

Only trace emissions of N-nitrosodiethylamine and the general category of dialkylnitrosamines were reported from stationary sources in California. The total emissions of N-nitrosodimethylamine from stationary sources in California are estimated to be less than 1 pound per year, based on data reported under the Air Toxics “Hot Spots” Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Dialkylnitrosamines have been found in a variety of vegetables, fruits, cheeses, meats, and alcoholic beverages (NTP, 1994a). Additionally, dialkylnitrosamines may be formed in the gastrointestinal tract of humans and animals by ingestion of nitrite and nitrate containing foods (IARC, 1980).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of dialkylnitrosamines. However, the United States Environmental Protection Agency (U.S. EPA) has compiled ambient data for n-nitrosodimethylamine during 1975 from several locations in the United States. The overall mean concentration was 2.4 micrograms per cubic meter (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

A major source of N-nitroso compounds in indoor air is environmental tobacco smoke (ETS). ETS has been found to contain N-nitrosodimethylamine, N-nitrosodiethylamine, N-nitrosopyrrolidine, N-nitrososornicotine, N-nitrosodiethanolamine and other N-nitroso compounds (Guerin et al., 1992). ETS emissions of four N-nitroso compounds were measured from six cigarette brands popular in California and one reference cigarette. N-nitrosodimethylamine had an average emission of 0.57 micrograms per cigarette ($\mu\text{g}/\text{cigarette}$). N-nitrosopyrrolidine had an average emission of 0.10 $\mu\text{g}/\text{cigarette}$. Emissions for N-nitrosodiethylamine and N-nitrosomorpholine were below the detection limit of 0.02 $\mu\text{g}/\text{cigarette}$ (Daisey et al., 1994). Concentrations of N-nitroso compounds have not been measured in any statistically selected sample of residences in California or the United States (Hodgson and Wooley, 1991).

ATMOSPHERIC PERSISTENCE

The atmospheric persistence of N-nitrosodimethylamine and N-nitrosomorpholine are discussed under the summary sheets for these compounds. In general, this class of compounds exist in the gas phase and their dominant tropospheric loss process is by photolysis to form NO plus the dialkylamino radical (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

Although dialkylnitrosamines are reported as being emitted in California from stationary sources, no health values (cancer or non-cancer) are listed in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines for use in risk assessments (CAPCOA, 1993). For information on either N-nitrosodimethylamine, N-nitroso-n-methylurea, or N-nitrosomorpholine, please refer to their corresponding summary sheets.

HEALTH EFFECTS

Probable routes of human exposure to dialkylnitrosamines are inhalation, ingestion, and dermal contact (NTP, 1994a).

Non-Cancer: Little information is available on the acute and chronic effects of dialkylnitrosamines. Large doses of dimethylnitrosamine are known to cause hepatotoxicity in humans (Amdur, 1993).

Cancer: Many dialkylnitrosamines are potent carcinogens. Members of the class such as N-nitrosodimethylamine, N-nitrosodiethylamine and dibutylnitrosamine have been found to cause cancer in rats and mice. The alkyl substituents appear to determine in part the site of the cancer, at least in rats. The diethyl and dimethyl derivatives cause liver cancer in rats. In mice, liver neoplasms are seen with these compounds. Dibutylnitrosamine causes cancer of the urinary bladder in rats (Amdur, 1993).

The most recent cancer rankings and potency values available for specific dialkylnitrosamines are listed in Table 2.

Table 2 - Dialkylnitrosamines Cancer Information

Compound	CAS Number	Proposition 65	OEHHA Potency Value	U.S. EPA Ranking	IARC Ranking
N-Nitrosodi-n-butylamine	924-16-3	Carcinogen	3.1×10^{-3}		2B: Possible
N-Nitrosodiethanolamine	1116-54-7	Carcinogen	8.0×10^{-4}		2B: Possible
N-Nitrosodiethylamine	55-18-5	Carcinogen	1.0×10^{-2}		2A: Probable
N-Nitrosodimethylamine	62-75-9	Carcinogen	4.6×10^{-3}	B2: Probable	2A: Probable
N-Nitrosodiphenylamine	86-30-6	Carcinogen	2.6×10^{-6}		3: Not Classifiable
N-Nitrosodi-n-propylamine	621-64-7	Carcinogen	2.0×10^{-3}		2B: Possible
N-Nitroso-N-ethylurea	759-73-9	Carcinogen	7.7×10^{-3}		2A: Probable
3-(N-Nitrosomethylamino)propionitrile	60153-49-3	Carcinogen			2B: Possible
4-(N-Nitrosomethylamino)-1-(3-pyridyl)1-butanone	64091-91-4	Carcinogen			2B: Possible
N-Nitrosomethylethylamine	10595-95-6	Carcinogen	6.3×10^{-3}		2B: Possible
N-Nitroso-N-methylurea	684-93-5	Carcinogen	3.4×10^{-2}	B2: Probable	2A: Probable
N-Nitroso-N-methylurethane	615-53-2	Carcinogen	3.1×10^{-2}		2B: Possible
N-Nitrosomethylvinylamine	4549-40-0	Carcinogen			2B: Possible
N-Nitrosomorpholine	59-89-2	Carcinogen	1.9×10^{-3}		2B: Possible
N-Nitrosornicotine	16543-55-8	Carcinogen	4.0×10^{-4}		2B: Possible
N-Nitrosopiperidine	100-75-4	Carcinogen	2.7×10^{-3}		2B: Possible
N-Nitrosopyrrolidine	930-55-2	Carcinogen	6.0×10^{-4}		2B: Possible
N-Nitrososarcosine	13256-22-9	Carcinogen			2B: Possible

References: CCR, 1994; IARC, 1987; U.S. EPA, 1994a